

# Audit

# Report



OFFICE OF THE INSPECTOR GENERAL

**NAVY'S AIRCRAFT STRUCTURAL LIFE SURVEILLANCE  
PROGRAM DATA RECORDERS**

Report Number 93-022

November 12, 1992

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**Department of Defense**

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REPORT  
NO. 93-022

November 12, 1992

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (PRODUCTION AND  
LOGISTICS)  
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL  
MANAGEMENT)

SUBJECT: Report on the Audit of the Navy's Aircraft Structural  
Life Surveillance Program Data Recorders  
(Project No. 2LB-8009)

### Introduction

We are providing this final report for your information and use. This audit was performed in response to a DoD Inspector General hotline allegation that the Navy's planned \$188 million procurement of structural data recorders under the Navy's Aircraft Structural Life Surveillance Program duplicated existing Navy recorder systems. The recorder monitors the structural stress that an aircraft experiences during operation. Our objective was to evaluate the validity of this allegation. We also evaluated the effectiveness of applicable internal controls.

### Audit Results

The Navy's Aircraft Structural Life Surveillance Program data recorder does not duplicate any existing Navy recorder systems. The structural data recorder does duplicate functions of a similar Air Force system. However, it is no longer practicable or economical for the Navy and the Air Force to combine their structural recorder systems because both have already installed and integrated these recorder systems in substantial numbers of aircraft.

### Scope of Audit

We reviewed records covering the period from June 1987 through July 1992 documenting the justification and procurement of the Navy's Aircraft Structural Life Surveillance Program data recorders. We also reviewed and evaluated records for the Navy's existing flight recorder systems to assess potential duplication. We also looked beyond the allegations to determine if the Navy's Aircraft Structural Life Surveillance Program data recorders would duplicate structural recorder systems available in the other Military Departments. This included an evaluation of

potential duplication of the Army's flight data recorder/fault analyzer and the Air Force's standard flight data recorder. Activities visited or contacted are listed in Enclosure 1.

This economy and efficiency audit was made from April through July 1992 in accordance with auditing standards issued by the Comptroller General of the United States as implemented by the Inspector General, DoD, and accordingly, included such tests of internal controls as were considered necessary.

### Internal Controls

We evaluated internal controls applicable to the justification and acquisition of the Navy's Aircraft Structural Life Surveillance Program data recorders. The internal controls applicable to the audit objectives were deemed to be effective in that no material deficiencies were disclosed by the audit.

### Background

The Navy's Aircraft Structural Life Surveillance Program includes a data recorder, consisting of electronic hardware and software that monitors the structural stress of an aircraft during its operations, and a ground station for processing the recorder's data. The recorder extracts and records aircraft flight performance data, such as airspeed, vibration, stresses, altitude, control surface positions, mission time, and engine operation over an extended period, to analyze the fatigue life of an aircraft. The Aircraft Structural Life Surveillance Program data recorder is designed to be used on older aircraft that do not have embedded data recorders. The Navy believed that the structural recorders would increase accuracy when calculating the fatigue life of an airframe, thereby improving flight safety and maximizing service life of an aircraft.

On June 26, 1987, the Navy began procurement of Aircraft Structural Life Surveillance Program data recorders by awarding a 5-year production contract valued at \$26.4 million and a separate 5-year engineering and technical support contract valued at \$30.2 million. These two contracts were to expire in June 1992; however, the Navy has extended the contracts through December 1992. As of June 1992, 660 Aircraft Structural Life Surveillance Program data recorders had been procured and installed on the A-6E, E-2 and TA-4J aircraft. At the time of audit, the Navy was planning a March 1993 award of a 5-year follow-on production contract, estimated at \$101.2 million, and a 5-year follow-on engineering and technical support contract, estimated at \$30.2 million. The follow-on production contract is to provide for the procurement of 1,574 recorders to be installed on C-2A, F-14A, H-46, AH-1W, P-3B/C, S-3, C-130, H-53, and

SH-60 aircraft. The Navy attributed the delay in the contract award process to the reorganization and loss of personnel in the contracting function.

#### Prior Audits and Other Reviews

There has been no audit coverage of this specific subject during the past 5 years.

#### Discussion

An allegation received through the DoD Inspector General hotline that the Navy's Aircraft Structural Life Surveillance Program data recorder duplicated existing recorder systems, including the Navy Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System, was not substantiated.

In response to the allegation, we compared the Aircraft Structural Life Surveillance Program data recorder to other Navy recorder systems including the Navy Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System. We also compared it to recorder systems in the Army and Air Force.

Aircraft Structural Life Surveillance Program data recorder. The Aircraft Structural Life Surveillance Program data recorder was developed to replace the counting accelerometer system. The counting accelerometer is an aircraft fatigue life monitoring system installed on older aircraft, such as the C-2A, P-3, F-14A, and S-3A aircraft and is considered obsolete because its data recording is limited to one flight parameter, vertical acceleration. Other flight parameters, such as aircraft airspeed, altitude, control surface positions, and mission data, which significantly affect aircraft loading severity and fatigue life of an aircraft, are not recorded by the counting accelerometer system. Accurate flight parameter and stress data are becoming more critical because shrinking budgets will result in older aircraft staying in service longer. The Navy plans to use this stress information to assist in determining when an aircraft's service life can be safely extended.

The Aircraft Structural Life Surveillance Program data recorders will also be installed on other aircraft that have no fatigue monitoring systems, such as the E-2, AH-1W, H-46, H-53, C-130, and SH-60 aircraft. However, these data recorders will not be installed on aircraft that have existing embedded recording systems, such as the F/A-18 and F-14B/D aircraft.

Enhanced Comprehensive Asset Management System and Maintenance Data Processing System. The Aircraft Structural Life Surveillance Program data recorder does not duplicate the Navy Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System. The Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System are ground processing stations used to extract, process, and store maintenance data collected and prerecorded on the F/A-18 and F-14B/D aircraft' embedded data recorders. The ground processing stations generate reports evaluating aircraft engine and weapon system performance characteristics, including engine life cycle usage and structural fatigue, that are used to forecast future maintenance requirements.

Although Aircraft Structural Life Surveillance Program data recorders require ground processing stations, they cannot use the Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System. The ground processing stations for the Aircraft Structural Life Surveillance Program data recorders rely on various supplier selected software languages that are compatible with the technology contained in the sensors on older aircraft. The Enhanced Comprehensive Asset Management System and replacement Maintenance Data Processing System use a specialized software language that was designed specifically for interface with the embedded data recorders on the F/A-18 and F-14 aircraft, which generally is not compatible with the sensors found on older aircraft.

The ground stations also differ in that the ground station for the Aircraft Structural Life Surveillance Program data recorder is used only as a recorder reproducer, which down loads data from flight recorders. The data are then transferred to a main data processing facility for analysis. The Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System are more complicated in that they are designed both to down load the data from flight recorders and to interface with other data bases.

Other Navy Recorders. The October 1991 "Final Report On Recorder Integration," prepared by a contractor for the Naval Air Systems Command and Naval Air Development Center, identified over 50 different types of recorders in use in various types of naval aircraft. The report concluded that there was little commonality among the 50 types of recorders.

Only three of the recorders were classified as "maintenance" recorders. The three "maintenance" recorders were the Aircraft Structural Life Surveillance Program's data recorder, F/A-18 aircraft embedded recorder, and F-14B/D aircraft embedded recorder.

The report indicated that while commonality of modules among all the different members of the common recorder family would be advantageous, combining the diversity of the different recorder missions may be difficult. The report concluded that a family of five types of common recorders, including structural (maintenance) recorders such as those being provided under the Navy's Aircraft Structural Life Surveillance Program, will have significant payback in supportability and resulting cost savings. In addition to maintenance recorders, the five types of recorders recommended included audio, video, acoustic, and computer data load recorders.

**Other DoD recording systems.** We also evaluated the Army flight data recorder/fault analyzer and the Air Force standard flight data recorder for possible duplication with the Navy's Aircraft Structural Life Surveillance Program data recorder.

**Army flight data recorder/fault analyzer.** The Army flight data recorder/fault analyzer is a flight incident recorder designed to record and ensure retention and recovery of the last 15 to 30 minutes of critical aircraft operation data in the event of a crash. Unlike the Navy's Aircraft Structural Life Surveillance Program data recorder, which captures and stores structural fatigue data for up to 30 days, the Army system is designed mainly for use during mishap (crash) investigations.

**Air Force standard flight data recorder.** The Air Force standard flight data recorder is used for collecting, processing, and storing data, such as mishap (crash), structural, aircraft tracking, and engine usage. It is not an embedded system and can be adapted for use on most types of aircraft. The standard flight data recorder consists of up to four airborne components, depending on the particular aircraft's requirement, and one ground station.

The standard flight data recorder is replacing existing recorders installed on the T-38, F-111, C-130, C-141, C/KC-135, B-52, E-3A, F-15A-D, and F-16A/B aircraft. The justification for procuring the standard flight data recorder for these older aircraft was that existing systems lacked reliability and were becoming unsupportable due to obsolete technology. For future aircraft the Air Force plans to use embedded recording systems.

The Air Force standard flight data recorder and the Navy's Aircraft Structural Life Surveillance Program data recorder acquisition programs do partially overlap. Both recorders collect data on the stress and fatigue experienced by an aircraft's structural components. However, the Air Force recorder, designed for newer aircraft, contains more capability than the Navy needs for its older aircraft.

Because less capability is required, the Navy can procure its structural data recorder at a lower unit cost than the Air Force recorder. The purchase price of an Aircraft Structural Life Surveillance Program data recorder, without support equipment or installation, varied from \$18,200 to \$30,200, depending on the unique aircraft model, quantity, and year procured. Cost for a Navy Aircraft Structural Life Surveillance Program ground station is approximately \$4,800. The purchase price of the Air Force's standard flight data recorder ranged from \$72,000 to \$91,000 (also without support equipment or installation). The price of the Air Force system's ground station was \$50,000.

In addition to the different requirements between the two Military Departments, it is no longer practicable or economical for the Navy to pursue the Air Force recorder. The systems are already installed and integrated in many Navy aircraft. At the time of our audit, the Navy had expended a total of \$56.6 million for Aircraft Structural Life Surveillance Program data recorders (\$26.4 million for hardware and \$30.2 million for the engineering and technical support). As of July 1992, a total of 660 recorders had been bought and installed on the A-6E, E-2, and TA-4J aircraft.

The Air Force was also completing the integration of the standard flight data recorder with its aircraft's avionics and has procured the system for 450 of its aircraft. At the time of our audit, the Air Force had expended a total of \$65 million for its standard flight data recorder (\$25 million for hardware and \$40 million for nonrecurring engineering and development). Integration continues for the F-15A-E, KC-135, and B-52 aircraft. The contract is in place through FY 1996 for 1,200 additional Standard Flight Data Recorders.

### Conclusions

The Navy Aircraft Structural Life Surveillance Program data recorder does not duplicate the Navy's Enhanced Comprehensive Asset Management System and its replacement Maintenance Data Processing System or other existing Navy recording systems. The Aircraft Structural Life Surveillance Program data recorder partially duplicated the Air Force's standard flight data recorder; however, it no longer was practicable or economical for the Navy to pursue the Air Force recorder because the aircraft installation and integration were already in place for both Military Departments.

Management Comments

We provided a draft of this report to the addressees on August 17, 1992. Because there were no recommendations, no comments were required and none were received. However, if you wish to provide comments to this final report, they should be provided by December 14, 1992.

We appreciate the courtesies extended to the audit staff. Audit team members are listed at Enclosure 2. If you have any questions on this audit, please contact Mr. Dennis Payne at (703) 692-3414 (DSN 222-3414) or Mr. James Kornides at (703) 692-3420 (DSN 222-3420). The planned distribution of this report is listed in Enclosure 3.



Edward R. Jones  
Deputy Assistant Inspector General  
for Auditing

Enclosures

cc:  
Secretary of the Navy



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Department of the Navy

Chief of Naval Operations, Washington, DC  
Assistant Secretary of the Navy, (Financial Management)  
Washington, DC  
Headquarters, Naval Air Systems Command, Arlington, VA

Marine Corps

Headquarters, Marine Corps, Arlington, VA

ENCLOSURE 1

**AUDIT TEAM MEMBERS**

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**ENCLOSURE 2**

**REPORT DISTRIBUTION**

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